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A2B
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(71) Applicants
BP Nutrition (UK)
Limited,
Stepfield, Witham, Essex,
CM8 3AB
(72) Inventor
Piers Calbert Tolley
(74) Agents
H. L. Eastman,
BP International Limited,
Patents and Licensing
Division,
Chertsey Road,
Sunbury-on-Thames,
Middlesex, TW16 7LN

(54) Animal feed supplement

(57) A tablet suitable for adding to animals' drinking water contains one or more vitamins and one or more trace elements and a water-soluble substrate, preferably an effervescent substrate containing an edible carboxylic acid and an alkali metal bicarbonate. Other components of the tablet may be a flavouring, an anti-oxidant, an anti-biotic, a growth promoter and an anti-algal and/or anti-fungal agent.

The tablets may be prepared by forming separate granules containing respectively, vitamins, trace elements and bicarbonate, with the edible acid being in the trace element granules. The invention includes a method of feeding animals by adding the tablets to animals' drinking water or aqueous feed.

SPECIFICATION

Animal feed supplement

5 This invention relates to animal feed supplements containing vitamins and trace elements.

It is known that farm animals, particularly pigs, poultry and calves, benefit from the addition of vitamins and trace elements in their diet. It is further known to add these micronutrients to the animals' drinking water so that supply to the animal is unaffected by loss of appetite. One existing commercial supplement uses a sugar base (dextrose or sucrose) for the micronutrients to ensure that the nutrients are readily and uniformly dissolved in the drinking water. The sugar base tends to be hygroscopic, however, and even when the supplement is marketed in sealed bags there is a tendency for the supplement to change from an initial free flowing powder to a solid cake.

It has now been found that the micronutrients can be produced in the form of tablets, which will dissolve readily in water.

Accordingly, the present invention, in one aspect, is a tablet suitable for adding to animals' drinking water comprising one or more vitamins, one or more trace elements and a water-soluble, substrate.

The vitamins may include one or more of Vitamins A, B₁, B₂, B₆, B₁₂, C, D, E, K, Nicotinic Acid, Folic acid, Calcium Pantothenate, Choline and Biotin. The trace elements may contain one or more of Iron, Cobalt, Manganese, Zinc, Copper, Selenium, and Iodine, although the last named may present difficulties in practice because of its tendency to react with other elements.

The trace elements may be present as compounds, particularly water-soluble salts, eg sulphates. Anhydrous or mono-hydrate salts are preferred, particularly in the case of iron salts.

Sugars
Vitamins and trace elements
Carboxylic acid
Sodium bicarbonate
Binder
Lubricant

The tablets may be formed in a variety of sizes and weight. Suitable sizes may be from 0.5 to 5.0 cm diameter and suitable weights from 0.25 to 12 g.

The preparation of the tablets may, advantageously, involve forming separate granules of the components and, according to another aspect of the invention, a method of preparing an effervescent tablet as described above comprises forming at least three sets of separate granules containing:

- (a) one or more vitamins
 - (b) one or more trace elements
 - (c) a water-soluble substrate
- and forming measured quantities of the granules into tablets by dry compression.

40 The tablets may include an anti-oxidant (eg Butylated Hydroxy Toluene, Butylated Hydroxy Anisole, or Ethoxyquinoline) to aid vitamin stability.

Other components of the tablets may be flavourings, anti-biotics, growth promoters (eg Zinc bacitracin) and anti-algal and/or anti-fungal agents (eg Benzethonium Chloride or quaternary ammonium compounds).

The water soluble substrate should be one that ensures that the tablets disintegrate and dissolve readily in water. It is preferably effervescent so that the tablets are self dispersive and avoid any need for stirring or agitation.

A preferred effervescent substrate may contain an alkali metal salt and an edible carboxylic acid. The alkali metal salt may be an alkali metal bicarbonate e.g. sodium bicarbonate. The edible carboxylic acid is preferably used in the anhydrous form and may be e.g. citric acid, tartaric acid, malic acid or fumaric acid.

Alternative substrate may be sugars (e.g. dextrose or sucrose), or alcohols derived from sugars (e.g. mannitol), preferably used with cold water soluble starches (e.g. pre-gelatinized maize starch) to improve disintegration of the tablet.

Other components of the substrate may be binder (e.g. acacia, malt dextrin, ethyl cellulose or tragacanth), a suspension agent (e.g. guar or guar derivatives, alginic acid or alginate salts) and a lubricant (e.g. potassium benzoate). An alternative to incorporating a lubricant in the tablet composition is to apply lubricant directly to the machine punch during tableting.

Soluble salts of metals not normally considered as trace elements in an animal diet may also be included (e.g. sodium chloride, magnesium sulphate, mono-calcium phosphate).

The tablets may have the components present in the following range of proportions:

Broad Range	Preferred Range
0 to 75% wt.	0 to 30% wt.
1 to 75% wt.	20 to 55% wt.
0 to 40% wt.	10 to 25% wt.
20 to 80% wt.	20 to 40% wt.
0.5 to 5% wt.	1 to 2.5% wt.
0 to 5% wt.	1.5 to 3.0% wt.

The water soluble substrate may be an alkali metal bicarbonate, and the trace element granules may contain an edible carboxylic acid.

A further set of granules (d) may contain one or more of growth promoters, anti-biotics, flavourings, anti-algal and/or anti-fungal additives and may be prepared and combined with granules (a), (b) and (c) above to form tablets.

In forming the separate granules it may be desirable to use a binder and/or to use a non-aqueous liquid as a moistener. Thus a binder as described above, particularly pre-gelatinised starch, may be used to form the granules, though a binder may not be necessary in the granules which contain the car-

boxylic acid. Suitable non-aqueous moisteners may be ethyl or isopropyl alcohols.

Not all the components of the tablet may be included in the granules. Thus the vitamin granules may contain only water-soluble vitamins and non-water soluble vitamins may be added separately as fat-solubilised forms. A lubricant for the tableting, if used, may also be added separately so that the actual components mixed to form the tablets may be three or more types of granules, a lubricant and non-water soluble vitamins. Alternatively, as indicated earlier, a lubricant may be applied directly to the machine punch during tableting. Having regard to the proportions of components given above the tablets may be formulated so that the individual tablet will dissolve in a relatively small volume of water, eg 1 to 100 litres, to give the required supply of micronutrients for that volume of water, so that individual animals can be supplied. Multiples of tablets can then be used for larger volumes of water.

Besides dissolving in water, the tablets will also dissolve in aqueous feeds (eg reconstituted milk substitute) and may be used to supply micronutrients to such feeds.

According to a third aspect of the invention, therefore, a method of supplying vitamins and trace elements to an animal comprises adding one or more tablets as described above or prepared as described above to animals' drinking water or aqueous feed.

The invention is illustrated by the following Examples.

Example 1

Four sets of granules were prepared from the following combinations of components.

35	1.	
	Vitamin A	0.20 kg.
	Vitamin D3	0.01 kg.
	Vitamin E	0.18 kg.
40	Menadione Sodium Bisulphite	0.10 kg.
	Riboflavin	0.30 kg.
	Nicotinic acid	1.50 kg.
	Calcium d-pantothenate	0.80 kg.
	Folic acid	0.05 kg.
45	Dextrose monohydrate	3.59 kg.
	Pre-gelatinized maize starch	1.00 kg.
50	2.	
	Copper Sulphate (pentahydrate)	0.9 kg.
	Cobalt sulphate	0.5 kg.
	Zinc sulphate	2.4 kg.
	Manganese sulphate	3.3 kg.
	Ferrous sulphate (exsiccated)	2.1 kg.
	Potassium chloride	1.1 kg.
55	Magnesium sulphate (dried)	3.1 kg.
	Citric acid (anhydrous)	5.0 kg.
60	3.	
	Choline Bitartrate	2.5 kg.
	Hyamine	1.0 kg.
	Dextrose Monohydrate	5.5 kg.
	Pre gelatinized maize starch	1.0 kg.
	Iso Propyl Alcohol	1.0 L.

65	4.	
	Sodium bicarbonate	10.0 kg.
	Dextrose monohydrate	20.6 kg.
	Acacia B.P.	1.0 kg.
	Potassium benzoate	1.0 kg.

Each combination was mixed and granulated in separate granulation stages. Each set of granules was dried at 55°C. and passed through a 12 mesh B.S.S. sieve. The granules were then mixed together and formed into 10 m.m. tablets by dry compression.

The tablets disintegrated in water with some effervescence and dispersed completely with little agitation.

The tablets produced from the above mix were dissolved in 100,000 litres of water and used to supplement the diet of poultry.

Example 2

Three sets of granules were prepared from the following combinations of components.

85	1.	
	Menadione sodium bisulphite	0.6 kg.
	Thiamine Hydrochloride	0.06 kg.
	Riboflavin	0.20 kg.
90	Nicotinic acid	1.10 kg.
	Folic Acid	0.04 kg.
	Calcium d-pantothenate	0.60 kg.
	Pyridoxine hydrochloride	0.13 kg.
	Ascorbic acid	0.50 kg.
95	Pre-gelatinized maize starch	0.14 kg.
100	2.	
	Copper sulphate (anhydrous)	0.38 kg.
	Cobalt sulphate	0.20 kg.
	Zinc sulphate	3.06 kg.
	Manganese sulphate	3.13 kg.
	Ferrous sulphate (exsiccated)	3.50 kg.
	Citric acid (anhydrous)	6.00 kg.
	Poly vinyl pyrrolidone	0.60 kg.
105	Industrial Methylated Spirits	3.60 L.
110	3.	
	Sodium bicarbonate	10.0 kg.
	Acacia B.P.	0.5 kg.
115	Each set of granules was prepared as in Example 1.	
	1.	
	The granules were mixed together with each other and with additional vitamins and a lubricant in the following proportions:—	
	Vitamin B12 (1:1000 on mannitol)	0.60 kg.
	Vitamin A	0.24 kg.
	Vitamin D3	0.005 kg.
	Vitamin E	0.40 kg.
	Potassium benzoate	1.00 kg.
	Granules 1	2.83 kg.
	Granules 2	16.87 kg.
	Granules 3	10.50 kg.

and formed into 16mm tablets by dry compression using flate bevelled edge tooling.

The tablets dissolved completely in water, without agitation, in less than 3 minutes.

The tablets produced from the above mix when dissolved in 200,000 litres of water were calculated to provide approximately one third of the vitamin and trace element requirements of poultry.

5 CLAIMS

1. A tablet suitable for adding to animals' drinking water comprising one or more vitamins, one or more trace elements and a water-soluble substrate.
2. A tablet as claimed in claim 1 wherein the water-soluble substrate is an effervescent substrate containing an edible carboxylic acid and an alkali metal bicarbonate.
3. A tablet as claimed in claim 1 wherein the vitamins are one or more of Vitamins A, B, B₂, B₆, B₁₂, C, D, E, K, Nicotinic acid, Folic acid, Calcium Pantothenate, Choline and Biotin.
4. A tablet as claimed in claim 1 or 2 wherein the trace elements are one or more of Iron, Cobalt, Manganese, Zinc, Copper, Selenium, and Iodine.
5. A tablet as claimed in claim 2, 3 or 4, wherein the edible acid is citric, tartaric, malic or fumaric acid.
6. A tablet as claimed in any of claims 1 to 5 wherein the tablet contains also a lubricant and/or binder.
7. A tablet as claimed in any of claims 2 to 6 having the components present in the following proportions.

Sugars	0 to 75% wt.
Vitamins and trace elements	1 to 75% wt.
Carboxylic acid	0 to 40% wt.
Alkali metal bicarbonate	0 to 80% wt.
Binder	0.5 to 5% wt.
Lubricant	0 to 5% wt.
8. A tablet as claimed in claim 7 having the components present in the following proportions.

Sugars	0 to 30% wt.
Vitamins and trace elements	20 to 55% wt.
Carboxylic acid	10 to 25% wt.
Alkali metal bicarbonate	20 to 40% wt.
Binder	1 to 2.5% wt.
Lubricant	0 to 3% wt.
9. A method of preparing a tablet suitable for adding to animals' drinking water as claimed in any of claims 1 to 8 comprising forming separate granules containing:
 - (a) one or more vitamins
 - (b) one or more trace elements
 - (c) a water soluble substrate, and forming measured quantities of the granules into tablets by dry compression.
10. A method as claimed in claim 9 wherein the water soluble substrate is a alkali metal bicarbonate.
11. A method as claimed in claims 9 or 10 wherein the trace element granules contain an edible carboxylic acid.
12. A method as claimed in claim 9, 10, or 11 wherein further granules (d) containing one or more of growth promoters, anti-biotics, flavourings, anti-algal and/or anti-fungal additives is prepared and combined with granules (a), (b), and (c).
13. A method as claimed in any of claims 9 to 12 wherein a dry lubricant is added to the mixture of granules before compression.
14. A method as claimed in any of claims 9 to 13 wherein a liquid lubricant is applied to the tableting

punch.

15. A method as claimed in any of claims 9 to 14 wherein the granules contain a binder and/or non-aqueous moistener.

16. A method as claimed in any of claim 9 to 15 wherein only the water-soluble vitamins are included in the vitamin granules, non-water soluble vitamins being added separately.

17. A method of supplying vitamins and trace elements to an animal comprising adding one or more tablets as claimed in any of claims 1 to 8 or one or more tablets prepared as claimed in any of claims 9 to 16 to animals' drinking water or aqueous feed.

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